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ABSTRACT

The formal education of laboratory personnel focuses primarily on the basic sciences and specific clinical laboratory practices. However, many of these personnel are called upon to teach students, new employees, and/or colleagues participating in continuing education/in-service activities. Often those called upon are totally unprepared for that role, due in part to their lack of or superficial exposure to even the most rudimentary principles and concepts associated with the teaching/learning paradigm. Therefore, a five-step approach is presented to help laboratory personnel called upon to teach in the clinical setting. The model does not purport to present any new or unique procedures. Rather, it attempts to bring together, in synergistic fashion, a variety of educational tenents. By following the approach, instructors will not only become aware of the characteristics of effective instructors and adult learners, but will also come to appreciate the complexity of the entire teaching/learning process. The approach consists of discussions related to: preparing for the role of instruction; preparing the learner for instruction; presenting the task/procedure; practicing the procedure; and evaluating the teaching/learning process. The approach has been used in a variety of clinical settings and has been found to generate positive results for both instructors and students. (JN)

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FIVE-STEP APPROACH TO EFFECTIVE TEACHING IN THE LABORATORY

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ABSTRACT

Most, if not all, medical technologists are responsible for conducting some kind of instructional activity. Yet, this aspect of their training is often neglected. Consequently, most laboratory personnel feel ill-prepared for the teaching role. This article presents a five-step approach to instruction which could help to produce positive results for those called upon to teach in the clinical setting.

INTRODUCTION

Laboratory personnel are trained to perform specific analyses using manual procedures or sophisticated instrumentation. To assure competence as health care professionals, their formal education focuses primarily on the basic sciences and specific clinical laboratory practices. However, many laboratory personnel are also called upon to teach students, new employees, and/or colleagues participating in continuing education/in-service activities. Often those called upon to teach feel totally unprepared for that role. This is due, in large part, to their lack of or superficial exposure to even the most rudimentary principles and concepts associated with the teaching/learning paradigm.

The purpose of this article is to present a five-step approach (fig. 1) to bench teaching which can be used by laboratory personnel who are called upon to teach in the clinical setting. This model does not purport to present any new or unique procedures. Rather it is an attempt to bring together, in synergistic fashion, a variety of educational tenents. The result, hopefully, will be that those laboratory personnel who study and use the five-step approach outlined below, will become more confident and effective in the teaching role.

MATERIALS AND METHODS

Preparing for the Role of an Instructor

Preparing for the role of instructor begins by comparing personal strengths and weaknesses with those traits and characteristics generally associated with effective teaching. One can then exploit personal attributes and attempt to improve deficiencies.

One should think of the teachers who have been most influential in the past and the qualities that made them effective. When this question is raised, certain characteristics are routinely identified. Those mentioned most often are "good organizational skills" and "knowledge of subject matter." Students enjoy working with instructors who have obviously planned for an activity, where relevant and appropriate amounts of material are presented in a logical sequence. They also expect instructors to be knowledgeable and to exemplify the "expert" role model.

Qualities such as friendliness, patience, concern for individuals, sensitivity, empathy, and a sense of humor are also mentioned. Students usually will respond positively in a situation where an instructor values their worth, accepts their ideas, and is sensitive and responsive to their needs and pressures. And, while they don't expect the instructor to be a "friend;" they do expect to be treated fairly and valued as human beings.

The ability to communicate -- to clearly state goals and learning outcomes, show enthusiasm for the subject, provide feedback, and listen -- enhances the learning process. Effective communication increases the students' interest, holds their attention and stimulates their active participation.

A summary of the attributes associated with exemplary instructors is identified by Apps (fig. 2).[1] In examining this list and the above characteristics, one comes to realize that probably all of these qualities can't be exhibited. Since students do, in fact, learn differently, the degree of importance given to specific characteristics will vary. However, one should examine these in an attempt to identify specific behaviors which might be subject to self-improvement.

Attitudes or beliefs, one's philosophy, about the teaching/learning process will determine much of what an instructor does. These are the basis for action and will influence (wittingly or unwittingly) the planning, organization, instruction and evaluation of the teaching/learning activity. Therefore, the examination of personal beliefs is essential. Some of the questions that need to be raised are: What is the nature of the learner? What constitutes learning? What is teaching? What is the instructor's role in the teaching/learning process?

In the clinical setting, the instructor should have little difficulty accepting a colleague, engaged in continuing education or in-service activities, as an adult. This same assumption should be made about the medical technology student soon to enter the profession. This acceptance of students as adults has important implications in the teaching/learning process. Androgogy, a term coined by

Knowles, is the art and science of helping adults learn.[2] Androgogy stresses relevant material and its immediate application. The assumptions of androgogy are that adults differ from children in self-concept, experience, readiness, motivation, and orientation to learning. Because most adult learners usually have a fairly well established self-concept and view themselves as responsible, capable and self-directed individuals, they desire to have their input considered during the planning process. On the other hand, some adults are insecure, frightened and anxious in a learning situation. Consequently, they may be very reluctant to become involved in any situation that threatens their self-concept and self-esteem. It is the instructor's responsibility to provide an atmosphere of acceptance, respect, security, and support.

The outcome of learning is generally thought of as some kind of change in behavior. Bruner indicates that learning involves three activities: 1) the acquisition of information, 2) the transformation or processing of information to make it meaningful and a part of the learner's knowledge, and 3) the evaluation of the information as to its completeness and relevancy.[3] With this in mind, it becomes obvious that learning is a very personal experience; there is no right or wrong way to learn. It would be difficult to try to teach specifically to everyone's unique learning style, however, attempts should be made to provide additional information and alternate teaching approaches when needed.

Studies have shown that when teaching adults, their learning can be enhanced if "principles of adult learning" are implemented. Robinson has summarized some principles of adult learning that are applicable in the laboratory setting (fig.3).[4]

Kidd has specified three R's of adult learning: 1) relevancy, 2) relationship, and 3) responsibility.(5) The information/activity presented must make sense (relevancy) and be related to previous experience (relationship) and the learners' needs. The last "r," responsibility, means that adults must assume responsibility for their own learning. The instructor may have to remind students that they have selected the profession and, therefore, should be motivated to learn all there is to know about it in order to become competent.

Teaching may be defined as planned intervention with the intent of facilitating a change in behavior. Stritter and Flair state that "an important element in defining clinical teaching is the differentiation between instruction and learning. Instruction is conducted by the teacher, and learning is accomplished by the student (however) ... the teacher cannot assume that the mere presentation of information ... will result in learning."(6)

The role of the instructor will vary. Usually in the clinical setting, the instructor will be the subject matter expert; a repository for the kinds of knowledge and skills necessary to function in the laboratory. The instructor may also be the counselor, advisor, planner, guide, motivator, facilitator, and coordinator. The instructor's demeanor, attitude, work habits, etc., are always being communicated, consciously or unconsciously, and can help students develop the necessary attitudes and skills by providing an appropriate role model.

In planning for instruction, the instructor must decide specifically what needs to be taught. Input to this decision may come from the accrediting agencies,

institution, curriculum committees, laboratory managers and supervisors, staff, or the students themselves. Once goals (broad statements relative to expected outcomes) and objectives (specific learning tasks) are determined, then appropriate activities must be planned.

The expected outcomes of a particular learning activity are communicated to students by specific instructional objectives, either in oral or written form. Using the format first developed by Mager, one might address the following questions when dealing with instructional objectives: 1) what will the learner be able to do, 2) under what conditions will the learner be able to do it, 3) how will the instructor and the learner know it has been accomplished, and 4) what constitutes acceptable performance.(7) With experience, instructors generally find that expected learning otucomes can be communicated to students with less detail than Mager's format requires.

According to Robinson, instructional objectives should be "brief enough to be remembered .. clear enough to be written down ... (and) specific enough to be attainable."(4) Figure 4 illustrates three simplified objectives that might be used when teaching the measurement of specific gravity by use of the refractometer, with the overall goal being the performance of a complete urinalysis. These objectives are written in terms of expected student behavior, not the instructor's. Measureable terms -- explain, measure, identify -- indicate how the objective will be satisfied. Terms that are ambiguous and unmeasureable such as know, understand and appreciate should be avoided. The specific criterion to be used in judging acceptable performance, i.e. ± .002 units, should be included in the objective. In

addition to communicating the expected outcome of a clinical activity to the student, the objectives should be the basis for planning the activity as well as evaluating the student and the instructional process.

Instructional activities in the clinical setting focus on cognitive, affective, and/or psychomotor learning. Cognitive learning is concerned with the acquisition and application of information/knowledge. If several students are present and a great deal of information needs to be disseminated, the lecture may be an efficient and effective teaching method. However, be wary of too much use of the "I pitch, you catch" approach. Other learning activities found to be useful when operating in the cognitive domain include independent study and demonstration. These methods involve students in the application of facts, concepts, and principles needed for problem solving.[8,9,10,11]

Affective learning is the development of professional attitudes and values. The most effective techniques include inquiry-oriented discussions and role playing.[8,9,10,11]

Psychomotor learning involves the development of specific physical skills needed to perform analyses and operate instruments. Demonstration by the instructor or viewing and listening to prepared audio-visual materials, followed by student practice, have been shown to be most effective in teaching "how to" activities.[8,9,10,11]

The selection of a particular teaching method or technique is dependent on the instructional objectives, as well as the subject matter, ability/experience of the instructor, number and the maturity/experience of the employees/students involved, and availability of facilities/equipment.

Preparing the Learner for Instruction

The instructor should attempt to establish the kind of supportive, non-threatening climate known to be conducive to learning. This is facilitated when the instructor gets "to know" the students both as learners and as individuals. Students can often be put at ease by reminding them of their previous successes and by expressing confidence in their ability to learn the new task. Interest in the activity can be created by stressing its relevancy -- the first of Kidd's three R's mentioned above. Often a brief history and a comment on its clinical significance will provide perspective and insight and help to motivate the students to learn.

The goals and specific instructional objectives for the learning activity must be discussed. Terms will need to be defined, points clarified, a timetable established and the criteria for acceptable performance specified. After this discussion, the instructor should assess what the students already know. If there are significant individual differences, these should be identified and alternative objectives and/or learning activities mutually agreed upon.

To assist the students in achieving the objectives, study material should be assigned and an overview of the basic principles provided. By taking the time to prepare the learner, one of the most frequent complaints -- "I did not know what was expected" can be eliminated. And, even more important, being aware of what is expected usually results in the student making a commitment to learn.

Presenting the Task/Procedure

When teaching a task, break it into its component parts (fig. 5).[12] Slowly, patiently, demonstrate and explain each step. Tie in the new material with that previously learned (the second R of Kidd's) and stress key points and possible problem areas. Students quickly become bored and distracted if they are only expected to watch and/or listen. To hold the student's attention and interest, ask questions and have them repeat and explain the directions. By actively involving students in the learning process, interest will be stimulated and more information is likely to be retained. Finally, go over key points and steps that were unclear or confusing to the student.

Practicing the Procedure

Once the students are familiar with the procedure, have them practice it. The students should demonstrate each of the steps, while telling you what is being done and why. Encourage and reinforce appropriate behavior and correct errors as they occur in a non-threatening manner. Ask questions to verify understanding and have the students repeat steps when necessary. Ask students how they feel

about their performance and what, if anything, needs further improvement and/or clarification. Have the students repeat the process until you feel confident they are performing the task correctly.

At this point put the students on their own to apply the new knowledge and reinforce the behavior. Initially, check their progress frequently and encourage questions. As the learners become more confident and are able to acheive the acceptable performance criteria stated in the objectives, taper off your supervision but be available for assistance if needed.

Evaluating the Teaching/Learning Process

Just as quality control is an integral part of every laboratory procedure, evaluation must also become a part of the teaching/learning process. Evaluation must be planned; it is much more than testing and assigning grades. How else will the instructor know the student has achieved the objectives. Many instructors assume that evaluation is something done to students. They also assume that evaluation is done only at the end of the teaching/learning process. Both of these assumptions are erroneous. Evaluation should occur during the period of instruction as well as at the end. Evaluation should include an assessment of the learning as well as the instruction and should be conducted by both the instructor and student.[13]

The two main types of evaluation are formative, conducted during the activity, and summative, conducted at the end of the activity.[4,13] Both the instructor and the student should participate in these processes.

Formative evaluation by the instructor includes reinforcing and encouraging correct behaviors, correcting inappropriate behaviors as they occur, and asking questions to determine the level of the student's comprehension of the process. By observing and listening to the students, the instructor is continually aware of their progress and can and should alter the instruction accordingly.

Summative evaluation conducted by the instructor includes determining whether the students can exhibit/demonstrate those behaviors specified in the instructional objectives. If the students are not performing at an acceptable level or are unable to correctly identify, explain, etc., then additional time should be taken to remedy the problem. In addition to evaluating the students' achievement of the instructional objectives, the entire teaching/learning process needs to be considered. Was the material assigned or provided appropriate and sufficient? Was enough time allotted? Could the activity be broken down and sequenced differently? Would a different teaching method be more effective? Would more or less instructor involvement be beneficial? By continually addressing these questions, evaluating, and then adjusting and improving upon the teaching/learning process, the laboratory professional will become more confident in the role of instructor.

The students should be given an opportunity to assess their own achievement. They may desire additional time and/or instruction. They may also want to investigate related topics not specifically addressed in the activity. To assist the instructor in improving the quality of the teaching/learning process, the students should also evaluate the appropriateness and quality of the materials and

instruction. Including the students in evaluation encourages their learning and reinforces their responsibility in the process.

SUMMARY

The five-step approach to instruction has been used in a variety of clinical settings and has been found to generate positive results for both instructors and students. If this approach is followed, the instructor will not only become aware of the characteristics of effective instructors and adult learners, but will also come to appreciate the complexity of the whole teaching/learning process. Using this approach, instructors will experience the kind of self-satisfaction that goes with seeing students achieve the desired outcomes. Students will benefit from the planned instruction. Hopefully, the student will enjoy the experience and be motivated to continue to learn. This desire to continue to learn is essential for all competent laboratory professionals.

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Figure 1

Five-Step Approach to Teaching in the Clinical Setting

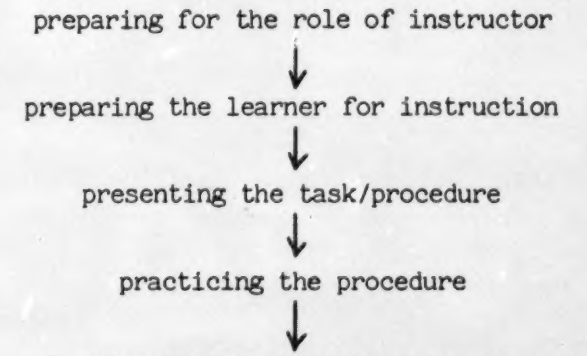
preparing for the role of instructor
preparing the learner for instruction
presenting the task/procedure
practicing the procedure
evaluating the teaching/learning process

Figure 2

Attributes of Exemplary Instructors

1. Are more concerned about learners than about things and events.
2. Know their subject matter.
3. Relate theory to practice and their own field to other fields.
4. Are confident as instructors.
5. Are open to a wide variety of teaching approaches.
6. Share their whole person.
7. Encourage learning outcomes that go beyond course objectives.
8. Create a positive atmosphere for learning.

Figure 3

Principles of Adult Learning

1. Learning is an active process.
2. Learning is goal-directed.
3. Learning that is applied immediately is retained longer.
4. Learning must be reinforced.
5. Learning new material is facilitated when it is related to what is already known.
6. Learning is facilitated when the learners are aware of their progress.
7. Learning is facilitated when there is logic to the subject matter.

Figure 4

Activity: Measurement of Specific Gravity (s.g.)
Using the Refractometer

Upon completion of this exercise you should be able to:

1. explain the principle of the refractometer for measurement of s.g.
2. correctly measure the s.g. of provided urine specimens with ± .002 units.
3. identify possible interfering substances to the measurement.

Figure 5

Procedure for Refractometer:

1. Hold refractometer horizontally.
2. Shut cover plate over measuring prism.
3. Use pipet to place drop of urine on exposed part on top of prism.
4. Hold refractometer towards light source.
5. Rotate eye piece until scale is in focus.
6. Specific gravity is the point on the scale where there is a sharp contrast of light and dark.
7. Wipe prism clean after each use.

(Refractometer must be set to 0.0 with DDW before starting.)